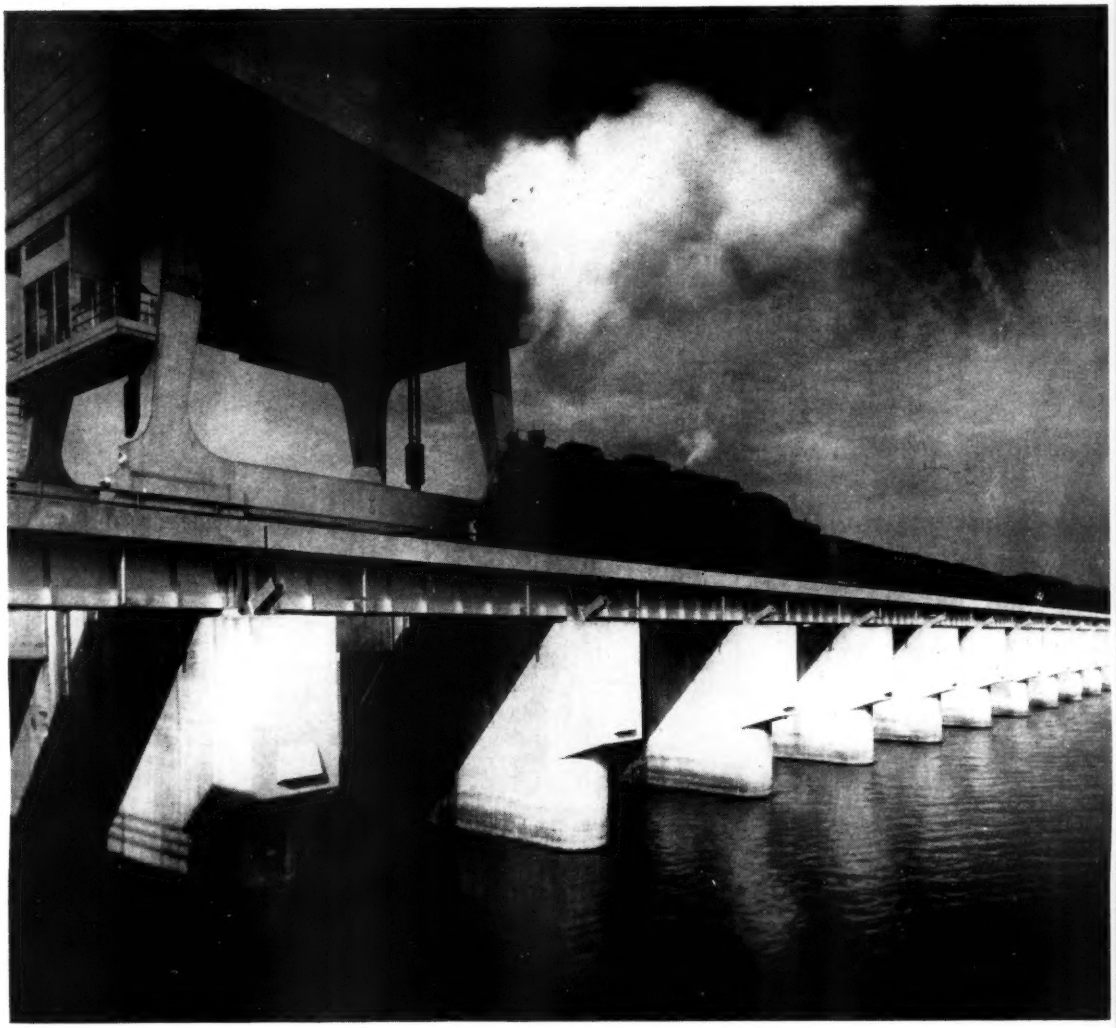
Midwest Engineer

SERVING THE ENGINEERING PROFESSION



WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

ENGINEERS' EMPLOYMENT OPPORTUNITIES
SURVEY OF RAILROAD MOTIVE POWER
WSE MEETINGS—PAGE TWO

Vol. 3 FEBRUARY, 1951 No. 6

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MIDWEST ENGINEER

A Publication of the

WESTERN SOCIETY OF ENGINEERS

Serving the Engineering Profession

February, 1951 — CONTENTS — Vol. 3, No. 6

COVER CREDIT

An Illinois Central freight train crosses the Gilbertsville Dam and Bridge, spanning the Tennessee River in Kentucky. This month's Midwest Engineer pays tribute to the Illinois Central Railroad on its 100th birthday.

this month at WSE

COMING EVENTS OF INTEREST TO ALL MEMBERS

Meetings begin at 7 p.m. unless otherwise indicated. There will be a short film before the speakers at the Monday night general meetings.

February 5, Underground Corrosion

SPONSORED BY GAS, FUELS AND COMBUSTION AND CHEMICAL AND METALLURGICAL ENGINEERING SECTIONS

Mr. M. G. Markle, gas engineer of the Public Service Company of Northern Illinois, will speak on the "Corrosion of Underground Structures." He will discuss, generally, some of the causes of corrosion of buried metals and related methods currently employed to mitigate and control corrosion of underground piping systems. Corrosion is a major problem of industry, and Mr. Markle's talk should be of interest to all engineers.

February 7, Final Profits Seminar

SPONSORED BY THE JUNIOR DIVISION

"What is the Role of Government in Our Economy?" is the tentative topic for the last in a series of four seminar type discussions on "Profits and Survival." **Daniel K. Chinlund** is the moderator.

February 10, Excursion to Plastic Plant

WSE members and guests will inspect the Chicago Molded Products Corporation plant at 1020 N. Kolmar Ave. in Chicago, from 9:30 a.m. until 11:30 a.m. This is the largest independent plastic molding plant, and a pioneer in plastics covering the design and building of molds, use of materials and finishing, inspection and testing of plastic products. Call RA 6-1736 for reservations.

February 12, Use of Structural Aluminum

SPONSORED BY THE BRIDGE AND STRUCTURAL ENGINEERING SECTION

Mr. Ernest Hartman, chief research engineer of the Aluminum Company of America, will come from Pittsburgh to address WSE members on the "Uses and Properties of Structural Aluminum." Mr. Hartman has been in charge of the physical testing of structural aluminum for the past 25 years.

February 19, Washington Award Dinner

WSE and the four founder societies will present **Edwin H. Armstrong,** professor of electrical engineering at Columbia University, with the 1951 Washington Award, at the Furniture Club of America, 667 N. McClurg Court, on Monday evening, February 19. The reception will begin at 5:30 p.m., dinner at 7 p.m. Professor Armstrong will talk on "Wrong Roads and Missed Chances—Some Ancient Radio History." Cost will be $4.75. Make reservations for yourself, your family, your business associates. Order a table for ten persons.

February 24, Repeat TV Excursion

Because the last excursion to WNBQ was completely filled before many members were accommodated, the excursion committee has made arrangements to repeat this trip on February 24, from 1:30 p.m. to 4 p.m. The tour will be divided into two parts, one starting at the 19th floor studio in the Merchandise Mart, the other part at the 42nd floor Transmitter in the Civic Opera Building. Call Mrs. Frasca, RA 6-1736, for reservations.

February 26, Smoker-Dinner to Meet Your Future Employees

SPONSORED BY JUNIOR AND STUDENT MEMBERS

This is the night when engineers in the field, the bosses of today, meet their employees of tomorrow. WSE student members will gather with professional members at a dinner meeting to begin at 5:30 p.m. A surprise speaker, a leader in industry and a person well acquainted with personnel problems of the engineer and management, will talk on a subject of great appeal to young engineers and all engineers with young ideas. There will be a big student turn out, let's see the professional members match it. Please make your reservations early. Call RA 6-1736.

March 2, Tribune Excursion

On Friday, March 2, WSE members and guests will tour the Chicago Tribune's printing plant. Highlight of the excursion will be the witnessing of the Tribune's high-speed presses printing the evening paper. The excursioners will also see samples of color work. There will be a short movie before the tour. Excursions start at 2 p.m., 4 p.m. and 8 p.m., and will last one hour and twenty minutes. Meet at the main entrance to Tribune Tower. Number is limited. Please call RA 6-1736 for reservations.

March 5, CBS Executive on Color TV

Mr. Peter C. Goldmark, vice-president of the Engineering Research and Development Department of the Columbia Broadcasting System, Inc. will talk on the much discussed and much debated subject of the "CBS Plan for Color Television." Tentative plans have been made to hold this meeting in the Commonwealth Edison Assembly Hall, in the Marquette Building, 140 S. Dearborn. Further details will be announced on the monthly meeting notice card.

March 7, Junior Division Movie

On Wednesday, March 7, at 7 p.m., the Junior Division will present a movie "In Our Hands." This picture will be closely tied in to the Juniors' Profits Seminars which ended in February.

Employment and Advancement Opportunities for Engineers

A panel discussion representing education, management, research, and personnel counseling sponsored by the Bridge and Structural and Communications Sections, January 8, 1951

Dr. Linton E. Grinter, Moderator
Illinois Institute of Technology

Dr. Henry T. Heald
Illinois Institute of Technology

Jay Hunter
Illinois Bell Telephone Co.

John Seifried
Ceco Steel Products Co.

Dr. Gustav Egloff
Universal Oil Products Co.

H. P. Sedwick
Public Service Co. of Northern Illinois

Before an alert audience of students, practicing engineers and engineering executives, a panel of five outstanding professional men briefed engineers on what they could expect in the way of future employment conditions.

Dr. Heald Figures Engineer Supply

Dr. Henry T. Heald, president of Illinois Institute of Technology, viewed the diminishing supply of engineers with some alarm.

Dr. Heald estimated that last year our American engineering colleges turned out about 50,000 graduates with first degrees. That was the all-time high. Prior to World War II this figure ran about 20,000 engineering graduates per year. Last year's 50,000 graduates were readily and totally absorbed by industry and government. Keeping this figure in mind, it is interesting to note that only 28,000 freshman have enrolled in engineering colleges this year.

"It has been estimated that the minimum needs for maintaining the kind of economy we are now in, will require about 30,000 engineering graduates each year. In 1951 our supply from engineering colleges will be about 30,000 or slightly higher if all those who are now students are permitted to graduate. If all present juniors were permitted to stay in college, only 23,000 would graduate in 1952. In 1953 the figure might be 17,000, and by 1954 the number of graduates might be down to 12,000 to 13,000. At any rate, this 1954 figure would be far below the pre World War II figure even without the draft decrease. But Selective Service does not, under present plans, have any intention of letting all those in college stay there.

"The basic problem facing the country, facing government, and facing industry is how are we going to maintain a reasonable continuous flow of people educated in engineering and science and other fields that are essential to the war effort.

"That answer has not yet been found. The question remains, where are we going to get an adequate supply of people with an engineering education? If it is a good thing for every individual to serve where he can make his greatest contribution, then best qualified people should be permitted to continue their education in spite of the immediate manpower needs of the military forces."

Jay Hunter Tells Bell Plan

The next panel speaker, Mr. Jay Hunter, personnel manager of the Illinois Bell Telephone Company believes that one of the best ways to foretell the future is to examine the past. Therefore, for his part in the panel discussion Mr. Hunter told the Illinois Bell experience in the employment and recruiting of engineering graduates.

"The Bell System has had a coordinated college recruiting program since 1920. Participating in this are some 17 operating companies and the Bell Telephone Laboratories and Western Electric Company. The recruiting is coordinated by the local operating company with the schools located in its territory. The objective of the program so far as the schools are concerned is to maintain a continuity of contact with them and to avoid duplication and confusion in the recruiting. The objective so far as the companies are concerned is to employ well qualified men for life-time careers in the Bell System."

"As a result of this program and other employment," Mr. Hunter went on to say, "the Bell System has in its employ some 20,000 college graduates and about half of them are engineering trained."

Mr. Hunter figured that about two-thirds of the engineers with Illinois Bell were recruited from the colleges. In numbers, more men with electrical degrees are employed with IBT and next in order are mechanical and then civil. By comparison, only one quarter of the non-engineering graduates were recruited.

Illinois Bell feels that over the years there has been more difficulty in employing well qualified engineering graduates than non-engineering ones.

Advancement and opportunities are practically boundless in the Bell System.

(Continued on Page 4)

Employment and Advancement Opportunities for Engineers

Engineering graduates hold a wide variety of jobs with Bell, everything from the purely developmental and research levels in the Bell Laboratories to engineering, administrative and executive jobs in the operating companies. The president of Illinois Bell, William V. Kahler, for example, is an engineering graduate.

As for the future, Mr. Hunter believes that the Bell employment program should be not different from its past experience and practice. He concluded by saying that the Bell plan contemplates balanced even intake over the years to provide the necessary people to run the business 5-10-20 years from now and to do this consistent with the immediate needs of the business and the present defense program in the country.

John Seifried on Employment Agencies

Speaking from the standpoint of the employment agencies, Mr. John Seifried, district manager of Ceco Steel Products Company and chairman of the Chicago advisory board of the Engineering Societies Personnel Service, told the audience of the outstanding changes which have taken place in the engineer employment situation during the past year and a half.

Present employment conditions found by the ESPS are these: for 1949 and the first half of 1950, there were four registrants for every job that was offered. Today, the exact opposite situation is true, with five jobs for every applicant. The greatest demand is for mechanical engineers, with electricals, civils, and mining following in order.

The present scarcity of engineers dictates the rule that there must be a more efficient use of engineers. If the employer is to reap the greatest value from his engineering personnel, he must be sure that the engineer devotes all his time to engineering work.

Mr. Seifried offered these tips for employers looking for engineers:

1. Give an explicit description of the job you want filled.
2. Give the qualifications of the man that you want to fill this job.
3. Then look to such sources of engineers like universities, the ESPS and similar agencies, rather than spreading the word from one to another.
4. When you interview a man be sure you obtain a complete record. Make your interview sufficiently long so that you can get all your information needed to form an opinion.
5. Ask for references and talk to those references.
6. Remember that in these times it is necessary to make a careful selection.

These are some of the suggestions Mr. Seifried made to engineers applying for a job:

1. Tell the prospective employer exactly the type of job you want.
2. Give qualifications and history in detail.
3. Don't hesitate to put your required salary down.
4. Investigate the firm before you join it. Look up its Dun and Bradstreet rating; talk to other engineers with the firm; discuss the opportunities with older engineers.

Dr. Egloff Urges Advanced Study

"The scientific and development end of engineering has as many opportunities for originality as any other type of research," declared Dr. Gustav Egloff, director of research with Universal Oil Products Co.

"Those student engineers who go on for a higher degree (either Masters or Doctors of Engineering) show the results of the extra study years put something into the individual, lacking, in general, in many of the engineers receiving the B.S. degree," he continued.

"Benefit from additional formal education is also realized in higher income. For example, starting compensation paid today in the Chicago area to men just out of college, range as follows:

For a B.S., $250.00 to $300.00 per month; for a Master's, $300.00 to $350.00; for a Doctor of Engineering, $425.00 to $500.00. These figures were checked through a number of companies, colleges and universities in the Chicago area, bringing salaries of engineers today considerably above those of 1946.

"The graduating engineers' percentage, for the three degrees for the year, 1946, are shown in Table 1.

"In the year 1949, a total of 47,216 engineers were graduated, of whom 42,000 were B.S., 4798 M.S., and 418 Ph.D's in Engineering. Table 2 gives the number graduating in the field of chemical engineering, electrical, mechanical, civil, mining and metallurgical, and aeronautical.

"The number of engineering graduates, according to Dean S. C. Hollister, for June, 1950, was 50,000, while he estimated for 1951 there will be only 32,500; in 1952, 21,900; and for 1954, 12,400. Serious as is the shortage of

(Continued on Page 29)

Table 1.—Percentage Distribution of Engineers by Educational Level for Each Field of Engineering Employment, 1946

Field of engineering employment	Total	Doctor	Master	Bachelor	Incomplete College	No College
Chemical	100.0	5.7	18.5	69.1	5.8	0.9
Civil	100.0	1.2	9.8	65.8	19.4	3.8
Electrical	100.0	2.1	11.8	68.7	13.9	3.5
Mechanical	100.0	1.8	10.9	67.9	15.9	3.5
Mining and Metallurgical	100.0	5.2	17.9	62.4	12.2	2.3
Other	100.0	2.3	11.2	60.7	21.0	4.8

Table 2
1949 Engineering Graduates

Field	B.S.	M.S.	Ph.D.
Chem. E.	4,135	748	151
E. E.	10,314	1,080	72
M. E.	11,620	864	40
C. E.	6,119	743	34
M. M. E.	1,098	224	36
Aero.	1,429	305	16
All Engr.	42,000	4,798	418

Make Headquarters part of your daily schedule

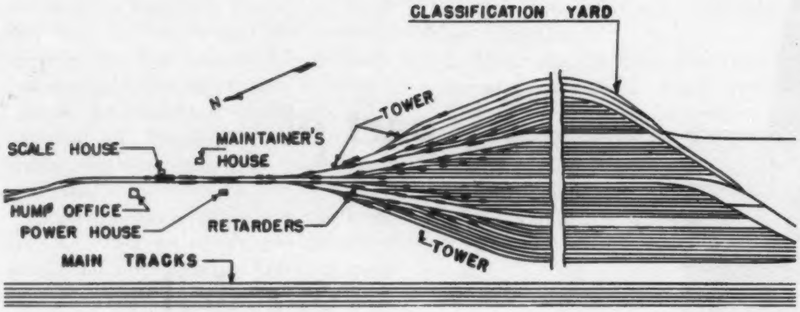
Top, Dining Room
Middle, Lounge
Right, Large Auditorium

- ***Relax in the lounge***
- ***Meet your friends***
- ***Lunch leisurely***
- ***Dine with the family***
- ***Use the lounge and dining room for your parties***
- ***Luncheon- 11 a.m. - 2 p.m.***
- ***Dinner- 5:30 p.m. - 8 p.m.***

Monday night meetings are planned specifically for the members' interest. They keep members up-to-date with the improvements and discoveries in their fields. Thursday noon luncheons are held each Thursday from 12:15 to 1:30 p.m. For just $1.15 members and guests receive a generous meal, hear a stimulating speaker, and join in good fellowship. For reservations call RA 6-1736.

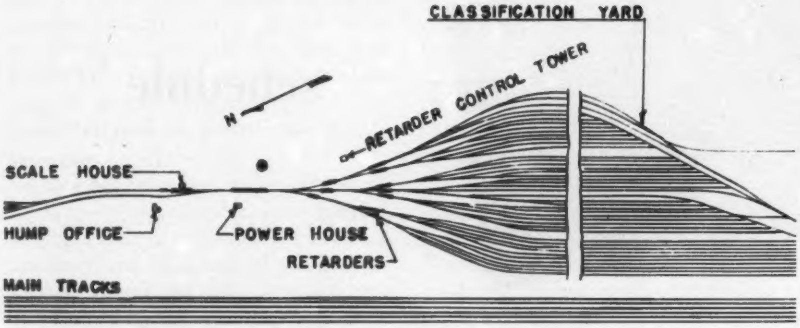
Headquarters of The Western Society of Engineers

Markham Yards Gets A Face Lifting



Illinois Central modernizes its southside classification yards to meet increased traffic.

Left: Diagram shows Markham's southbound class yard before improvements. Note large number of retarders, towers, crowded effect.



Left: New arrangement of yard irons out congestion, reduces number of control towers to minimum.

In May, 1949, the Illinois Central began a $3,000,000 program to enlarge and improve Markham Yard, one of the country's big freight classification yards, located on Chicago's south side. The improvement program, which will require about five years for completion, includes the installation of new and more powerful retarders, a change in gradients, the elimination of old retarder operator's towers and the installation of a push-button machine for the automatic control of switches. Markham will be the first yard in which classification of freight cars is accomplished by this unified push-button control.

Markham Yard was constructed to meet the demands of increased traffic following World War I when it was determined that the then present yard facilities were no longer adequate to handle the great volume of traffic with necessary efficiency and dispatch. As a result, Markham was born in 1926. Once again, after the second World War, the I.C. has seen that further improvement of the two classification "hump" yards at Markham is essential for the continued program of good freight service.

The latest improvements in railroad engineering have been incorporated in Markham facilities. Some of the outstanding features are:

Car retarders in each classification yard, thereby, eliminating the necessity of car riders.

Flood light illumination by batteries of electric lights mounted on high towers, permitting around-the-clock operation.

Plate fulcrum scales on each hump with automatic recording devices.

Pneumatic tubes for handling waybills to and from the General Yard Office.

Teletype machines for writing train consist lists in various switch towers and the hump foreman's office.

Intercommunication system between yardmaster's offices and towermen in the classification yard.

Radio-telephone service between hump foreman's office and hump switching engineer.

Automatic telephones connecting with other such phones on the entire Chicago Terminal of the railroad.

Color light signals for controlling the movement of pusher engines while humping cars.

Mechanical terminal for servicing locomotives.

Repair yard for making repairs to cars.

Push-button automatic control of switches.

Three Part Unit Arrangement

Markham consists of two major units, one for northbound traffic, the other for southbound traffic. Each unit is made up of a receiving yard, a hump classification yard and a departure yard.

The northbound unit at present has a receiving yard of 13 tracks of 80 to 110 car capacity. An adjacent supplemental yard, known as a rehumper, has 4 tracks each with a capacity of 50 cars. The classification yard has 62 tracks with a

capacity of 20 to 60 cars. The departure yard has 10 tracks each with a capacity of 80 cars from which transfer trains are operated, making deliveries to connecting lines, industries and other facilities located within the limits of the Chicago Terminal switching district.

The southbound unit, where push-button control will go into operation first, consists of a receiving yard of 14 tracks of 80-car capacity. The hump classification yard is similar to the one in the northbound unit. It has 45 tracks each with a capacity of 25 to 50 cars. The departure yard has 10 tracks of 100-car capacity from which road trains are operated.

Above: View from retarder control tower overlooks humping yard.

New Type Automatic Switching

The present improvement program for the southbound hump at Markham utilizes a push-button control machine which enables an operator in the hump office to set all switches automatically from the top of the hump to the classification tracks below by simply pushing a button corresponding in number to the classification track to which the car is destined. The circuit is so constructed that when the operator presses button 23, for example, each switch on the route from the crest of the hump to classification track 23 is automatically set ahead of the car as it advances down the hump. Track circuits are laid out in such a manner that it is impossible for a switch to be thrown while a car is passing over it. This installation is the first of its type in the western hemisphere. Mechanisms actually operating each switch are located at the switch to be operated. The newly-built retarder tower houses the control relays while the control panel is located in the hump office.

Car Retarders Installed

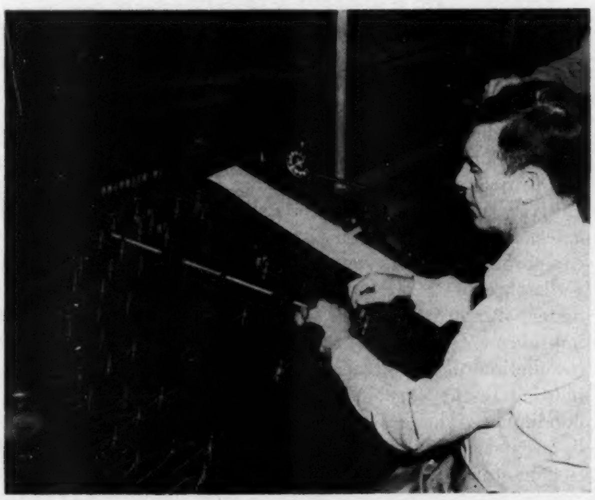
Car retarders have been installed from the top of the humps down to the ladder tracks on each unit to control the speed of the cars and permit them to enter the classification tracks at the proper speed. The grades of the classification tracks were designed for the car to maintain the speed at which it enters the track under normal weather conditions. The retarders consist of a series of brake-shoes placed along each side of the rail which grips both sides of the car wheels as they pass through the retarder. The amount of reduction in speed of the car is determined by the degree of pressure applied by retarder operators from control rooms in towers overlooking the hump.

The retarder installation on the northbound hump is electropneumatic while the installation on the southbound hump is entirely electric. On the electro-pneumatic type there are four different pressures, and the operator uses whichever pressure is necessary to reduce the speed of the car. The operator can determine from a switch list that is teletyped to him the amount of pressure necessary from the contents of the car, a load of coal or steel requiring more pressure than a load of cotton or empty containers.

(Continued on Page 8)

Below: With a simple push of a button, this operator sends car from crest of hump to proper class track.

Below: Retarder operator controls speed of car from the control tower, throws switch to reduce pressure.



Markham Yards Gets A Face Lifting

(Continued from Page 7)

On the all-electric retarders, braking pressure is obtained by means of spring pressure dependent on the position of the brake-shoes; the distance between the faces of the shoes being least when the operator desires greatest retardation.

There are five towers controlling the retarders and switches in the northbound class yard, and until the present improvement program began, there were four such towers in the southbound yard. However, under the present modernization program the four towers in the southbound yard are being replaced by a modern brick tower from which all retarders except the scale retarder will be operated. The 52 retarders in service in the southbound yard are being replaced with 12 retarders of more modern and powerful design. This change is possible through a rearrangement of tracks leading to the classification tracks.

The speed of cars can be so accurately controlled by experienced car retarder operators that the cars can be uniformly delivered to the proper classification tracks with sufficient speed to couple with the next car in line without undue shock to cars or lading. The use of retarders has eliminated the dangerous work of car riders.

Flood Light Illumination Used

Markham Yard is designed to operate 24 hours a day making adequate lighting a necessity. Powerful batteries of electric projectors mounted on steel towers 90 to 120 feet high at several locations in the yard provide the necessary illumination for night operation. Forty-five projectors are used in lighting intensively an area of approximately 300 acres. These lights are so powerful that comparatively small type can be read at a distance of 2,000 feet from a tower battery in reasonably clear weather. The improvement program provides for the installation of powerful sodium vapor lighting in the yard in addition to the floodlights. The new sodium vapor lights make possible adequate illumination in stormy or foggy weather.

Install Plate Fulcrum Scales

At the apex of each hump there is a plate fulcrum scale with 400,000 pounds capacity. Before weighing, the cars are uncoupled and separated. The platform is long enough to accommodate the car on the scale for at least four seconds when the humping rate is three cars per minute. Four seconds is sufficient time for the automatic recording device to register the weight of the car. During the cold weather the scale pit is heated by means of a hot water plant so that a uniform temperature will be maintained throughout the year, thereby, keeping the scale properly adjusted for accurate weighing.

Pneumatic Tubes Handle Waybills

Markham is equipped with a system of pneumatic tubes extending between the various yard offices and the general yard office. When trains arrive in the yards, conductors immediately place the waybills in a carrier which is tubed to the general yard office. Here the bills are checked both for destination and billing instructions. From this information and the consist of the train, which is furnished by the conductor, a switching list is prepared for the hump foreman. This list is communicated to the hump foreman and the retarder tower operator by means of teletype machines. When cars are assembled in trains in the departure yard, information is furnished the general yard office as to the consist of the train. The waybills are then sent by pneumatic tube to the office at the departure end of the yard. This tube system not only makes possible faster operation of all types in the yard, but also obviates the necessity for messengers and a means of transporting them.

Communicate By Teletype Machines

Teletype machines are used to communicate switching lists from the general yard office to the offices of the hump foreman and to the operators in retarder control towers. The master machine is located in the general yard office. When the destinations of all cars has been determined and checked, the operator in the yard office types this information on a continuous roll of paper. The following information is shown:

Location of car in train numbering from head end
Car number
Contents
Destination by station or railroad
Number of track to which it is to be sent in classification yard.
Heavy or light load

This information is reproduced in the hump foreman's office and in the retarder towers of the respective units. Each towerman and the yardmaster knows the destination of every car that moves over the hump, and can determine from the contents whether or not it is heavily or lightly loaded. From this information the retarder operator can determine the necessary amount of retardation to be used in handling each car as it moves from the hump to the classification tracks.

Intercommunication on Humps

Each hump foreman's office and tower is equipped with a microphone and loudspeaker to enable conversation between the foreman and the tower operator. There are cases where it is necessary in the operation of the hump to quickly change the destination of a car because of a bad order occurring after the teletype switch list has been prepared, or on account of a classification track having been filled making it necessary to continue a particular classification on another track. Under these conditions the foreman transmits such information to the tower operator by means of a microphone and there is no delay in the hump operation. The 165th Street yard office at the departure of the northbound classification yard, the office and the retarder towers are also connected with loudspeakers located in the northbound classification area, making it possible to issue instructions to crews and skatemen at that location.

Radio-telephone Service on Humps

Two locomotives regularly assigned to humping operations are equipped with radio-telephone sets. The northbound hump office also is equipped with a set, and intercommunication between locomotives and hump offices is constantly available. In cases where hand or light signals are inadequate to convey information, radio-telephone contributes materially to an efficient operation. The land radio station is located at the base of floodlight tower No. 5,

(Continued on Page 27)

Do your friends a favor...

Tell Them About WSE

1. Western Society is the only organization which offers complete club room facilities in the Chicago loop for as little as $20.00 per year. In addition, this sum offers to the engineer the following benefits:

2. Western Society is recognized as *the society* representing the engineering profession in the Chicago area. Its members are selected to serve on such important groups as the City Planning Commission.

3. Western Society represents a cross-section of the engineering profession. Its members have the opportunity to meet and know men from every branch of engineering.

4. Western Society membership offers personal contacts with outstanding leaders in engineering and business.

5. Western Society members have the opportunity to continue or brush-up on their education through the evening course work made available. The courses offered now include not only engineering work but broader studies in economics, public-speaking and philosophy with special emphasis on the relation of these subjects to engineering and the engineer.

6. Western Society, in the weekly meetings of its ten sections, offers the engineer an opportunity to keep abreast of technical developments.*

Serve the Society and your fellow engineers

Pickup several Application-Information Folders the next time you're at Headquarters

Give them to your friends, your business associates

*Gustav Egloff
February, 1951
Midwest Engineer

Illinois Central Celebrates Centennial in '51

So often people take for granted the utilities upon which they are dependent, their power, communications, transportation. The Illinois Central has served Mid-America for 100 years. It has contributed to the advancement and development of the middle west and to the Western Society of Engineers as well. The IC was prominent in the founding of WSE, and has proved a constant source of leadership ever since. On behalf of all its members, Western Society of Engineers congratulates Illinois Central on its first of many centennials.

One hundred years ago, in February, 1851, the Illinois Central Railroad was born in Springfield, Illinois. But its present railway system includes lines in the south which were conceived at the outset of the railway era in America. Its oldest existing line, the West Feliciana Railroad in Mississippi and Louisiana, was proposed in 1828, before the first steam locomotive appeared in the in the New World.

List IC Firsts

The Illinois Central was the first railroad in Illinois to build locomotives; it pioneered the operation of sleeping cars; and it was the first steam railroad west of the Alleghenies to convert its suburban passenger service to electric operation, thus starting another railroad trend.

The life blood of a railroad is its freight tonnage, and approximately 38 percent of the Illinois Central's tonnage in 1950 was coal. This coal was brought from the West Kentucky and Southern Illinois coal fields to supply power to industries in the Chicago area. The IC fostered the coal industry from its beginning by sinking the first shaft coal mine in southern Illinois in 1855.

As the first land-grant road, the Illinois Central also became the first railway company in the United States to promote large-scale colonization of its territories. Steeped in pioneer tradition, the Illinois Central played a leading role in laying the cornerstone of the Western Society of Engineers. As the railroad expanded, so did Chicago's industry, and with it came far-sighted engineers to the middle west. Among these engineers was one named Col. Roswell B. Mason, chief engineer of the new Illinois Central. Col. Mason was later to become the first president of the Western Society of Engineers. As the Illinois Central expanded, so did WSE. Six of the Illinois Central's twelve chief engineers have been WSE members. They are: Roswell B. Mason, John F. Wallace, A. S. Baldwin, August F. Blaess, Fred L. Thompson and C. H. Mottier, present chief engineer and vice-president, of the road.

The Illinois Central has engaged in a colorful history. During the Civil War, the older lines of the railroad in the north served under the Union flag, while those in the south served under the Confederate flag. This applied to the officers and men who later returned to their friendly relationships in the management and operation of the road. A traditional policy of the Illinois Central, since 1858, is the promoting and fostering of commerce between the central United States and foreign lands, especially Latin America, through its southern ports.

The Illinois Central has labored for the farmer, campaigning for crop diversification in its Southern territory. It has promoted scientific farming methods, dairying, soil conservation, reforestation and other agrarian activities designed to improve the lot of the farm population. In 1906 the Illinois Central fitted their "Corn and Seed Special" with seed and soil exhibits and this special train toured the Northern Lines of the IC, stopping to let farmers visit this unique "Agricultural College on Wheels." This farm aid was then extended to the Southern Lines, with the southern special known as the "Farmers' Instruction Train." This special was outfitted with the cooperation of Mississippi A & M, and expert agriculturalists delivered lectures at each stop.

IC Has Traveled Far

This railroad today is a far cry from the West Feliciana Railroad started in 1832. Railroad industry's first all-electric dining car was placed in service by the Illinois Central in 1949. The IC turned out an experimental fleet of aluminum hopper cars each representing a saving of five tons tare weight as compared with a steel car. Automatic intercity dial telephone service connecting railway offices and shops and other facilities between Jackson and McComb, Mississippi, and New Orleans, marked the first use in the United States of direct dialing between private branch exchanges in different cities.

The Western Society of Engineers congratulates the Illinois Central system on its first one-hundred years of transportation contributions to the Middle West, and wishes it many more hundred years of success.

WSEers Travel to East Chicago

Visit Edward Valves, Superheater Plants

WSE members and guests, bundled in extra heavy coats, boots and earmuffs, made the trip to East Chicago to tour the Superheater and Edward Valves plants, in the middle of one of Chicago's worst blizzards. But these hearty excursioners found the trip well worth the shivery journey.

Edward Valves' station wagons met the group at the train and brought them to the Superheater plant where they were greeted with a most welcomed hot lunch.

After lunch the tour continued through Superheater, where the 1100° F superheaters, high pressure boilers and the package steam generator were viewed and explained. Next the troupe gathered at Edward Valves Inc. where each one saw a new realm of modern technology, combined through metallurgy, precision machinery and careful inspection to make valves for the present high pressure-high temperature age.

Top: Engineers watch the assembly of large stop and check valve for 1800 psig and 1100° F at Edward Valves, Inc.

Bottom: Group sees radium used to detect sand holes and flow in high pressure valves.

Right: L. W. Tuttle and friend study the construction of a combustion steam generator at Combustion Superheater plant.

WSE EXCURSION CALENDAR FOR FEBRUARY AND MARCH

February 10—Plastic Plant Excursion

To: Chicago Molded Products Corp.
1020 N. Kolmar, Chicago
Time: 9:30 a.m.—11:30 a.m.

March 2—Tribune Trip

To: Chicago Tribune
Tribune Tower, Main Entrance
Time: 2 p.m., 4 p.m. or 8 p.m.

February 24—TV Tour

To: WNBQ
Merchandise Mart and Civic Opera Building
Time: 1:30 p.m.—4 p.m.

March 31—Inland Steel

To: Inland Steel Co. Plant
East Chicago, Indiana
Time: 10 a.m.

Edwin Howard Armstrong to Receive Washington Award February 19

This year's Washington Award will be presented to Edwin Howard Armstrong, research professor in electrical engineering at Columbia University, at the annual Washington Award Dinner, February 19, in the Furniture Club of America, at 667 N. McClurg Court, Chicago.

The sponsors of this exceptional recognition are the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers and the Western Society of Engineers, who administers the award.

Student and Professor at Columbia

The 1951 award recipient is a native New Yorker, and educated at Columbia University from which he was graduated in electrical engineering in 1913. Except for a period of military service, he has continued with the University in research. From 1914 until 1935, he was associated with Professor Michael Idvorsky Pupin, the 1928 recipient of the Washington Award, at the Marcellus Hartley Research Laboratory. Starting as an assistant in 1913, Edwin Armstrong became a full professor in 1934.

Pioneer in Radio Industry

Professor Armstrong is distinguished for inventions in radio, reception and transmission of outstanding importance. Much of the development in these fields is based upon his creative genius. His patents include the regenerative circuit 1912, the superheterodyne, 1918, the super-regenerative circuit, 1920, and the basic method for broad band frequency modulation, 1939. The latter, now known as "FM," largely eliminates the radio interference caused by atmospheric disturbances, such as static and lightning, and interference caused by a multitude of man-made electrical disturbances, such as arcing and switching surges. In the "FM" system invented by Armstrong, the signal strength is held constant and the frequency is modulated. This stands in direct contrast to the earlier concepts represented by the "AM" method. The fidelity of transmission and reception with "FM" marked the arrival of a new epoch in radio.

During the first World War Edwin Armstrong served as captain and major in the United States Signal Corps. He was with the A.E.F. from 1917-19 and was made Chevalier de la Legion d'Honneur. In 1941 he gave to the United States government free use for the period of the national emergency those nineteen patents bearing his name which covered the frequency modulating systems of communication.

Armstrong, Much Honored

Over the years Edwin Armstrong has received various honors and recognitions for his engineering achievements. In 1929 Columbia University awarded him the honorary degree of Doctor of Science and in 1941 he received an honorary Sc.D. degree from Muhlenberg College. Other recognitions included the Medal of Honor from the Institute of Radio Engineers in 1917; the Egleston Medal from Columbia University in 1939; "Modern Pioneer" plaque from the National Association of Manufacturers in 1940; the Holley Medal from the American Society of Mechanical Engineers in 1940; the Franklin Medal from the Franklin Institute and the John Scott Medal from the Board of City Trusts, City of Philadelphia, both in 1941; and the Edison Medal from the American Institute of Electrical Engineers in 1943.

To the illustrious names of engineers who have received the Washington Award another is added, Edwin Howard Armstrong.

Announce Public Service Co. Merger

Stockholders have approved the merger of Western United Gas and Electric Company and Illinois Northern Utilities Company into Public Service Company of Northern Illinois and elected eight new members to the Public Service Company board of directors, it was announced last month by Charles Y. Freeman, Public Service Co. chairman.

The eight new directors, all of whom formerly served on either the Western United or Illinois Northern boards, bring the total board membership of the enlarged corporation to seventeen. The new members are Preston A. Boyd, vice president, Henney Motor Company, Freeport; Harry E. Burkholder, general manager and treasurer (retired), Hardware Products Company, Sterling; R. F. List, executive vice president and director of sales, National Sewing Machine Company, Belvidere; Edward Vaile, president, Edward Vaile Clothing Company, Dixon; L. S. Stephens, president, Stephens-Adamson Manufacturing Company, Aurora; P. L. McPheeters, president, Wheaton National Bank, Wheaton; Walter I. Jones, president and treasurer, Farrell Manufacturing Company, Joliet; and Bernard E. Giertz, president (retired), Charles E. Giertz & Sons, and director, The First National Bank of Elgin, Elgin.

The nine continuing directors include Britten I. Budd, James D. Cunningham, Albert B. Dick, Jr., Stanley Field, Charles Y. Freeman, Willis Gale, William J. Kelly, Joseph H. King, and John Wentworth.

Mr. Budd, Public Service president, said that the merger of the three companies will be a distinct advantage to the public in meeting future gas and electric needs and provide a more efficient means of furnishing adequate service to the homes, farms and industries in the 11,000 square-mile area of northern Illinois to be served by the enlarged organization.

The merger previously had been approved by the Illinois Commerce Commission.

Crerar Library

News and Notes

Ionization of air and heat pumps; Geiger tubes and tractor axles; tempering of sheet steel and bonding of rubber to metal; thermo-electric safety controls and magnetic bearings—all reflect the great variety of industrial research problems brought to Crerar's Research Information Service. The purpose, of course, in bringing these problems to the Library, is to learn what experiences of others have been recorded in the vast maze of technical literature.

The purposes of library research are almost as varied as the subject matter. Prior art searches for data needed in patent litigation, or to avoid fruitless preparation of patent specifications for a device already perfected, verification of claims for a new product; sources of raw materials; new processes for reducing cost of manufacturers—are some of the many reasons companies request the aid of Research Information Service.

Among the most interesting of RIS assignments, are projects which call for current reports of technical progress in special fields. For example, several hundred metallurgical and other engineering journals are reviewed regularly for Reynolds Metals Company. As current issues of journals are received, they are scanned for technical papers bearing on the interests of the company. Important papers are abstracted with special reference to the needs of the company, and regular reports are prepared in the form of a monthly abstract bulletin for technical sales personnel.

Projects for two other companies involve preparation of news letters on technical papers, primarily for executives.

The purposes for which Research Information Service was founded in 1947 are: to avoid duplication in research; to stimulate new lines of investigation; to release research personnel for laboratory work and development of new products; and to assist investigators who are preparing material for publication. Over all, the purpose for which RIS was established was to enable one of the leading scientific libraries of the world to make a more dynamic contribution to industrial research.

memos on WSE members

This month has been one of change for WSE members at Marsh & McLennan. Major change is the retirement of **Joel R. Wilson,** after completing 40 years as head of the Chicago office's Fire Engineering Department. Mr. Wilson developed this department from a one-man operation to its present force of 29 engineers and an office and drafting force of 12 people.

Joel R. Wilson

Mr. Wilson, a native of Chicago, was educated in Chicago public schools, at Armour Academy of Science and in the fire protection course at Armour Institute. He received his early engineering experience with the Chicago Board of Underwriters where he worked in their inspecting and rating departments and later specialized in the study of new industrial processes and their related fire and explosion hazards.

His extra-professional activities are many. He is a member of WSE's civic committee, the National Fire Protection Association and its membership committee, International Association of Fire Chiefs, Association of American Railroads Fire Prevention Division, Executives' Club of Chicago, Chicago Association of Commerce and Industry's Fire Prevention Committee of which he was once chairman.

There have been other changes at Marsh & McLennan. **Mr. Leonard A. Foschinbaur,** a WSE member since 1946, is now manager of the Engineering Department.

Walter Zielenske has recently been appointed a consulting engineer at M & M. . . . and **William J. Finger** is their new hydraulic engineer.

After 16 years with the Corps of Engineers, of the U. S. Army, **C. H. Wicks** has joined the staff of the Chicago Gravel Co. with headquarters in Joliet, Illinois. Mr. Wicks will be engineer and assistant to the president of this company. Always active in WSE events, Wicks is resigning as the Society's Admissions Committee Chairman because of his relocation away from Chicago.

Gilbert K. Hardacre, WSE member and manager of commercial sales for Public Service Company of Northern Illinois, has been reelected president of the Chicago Lighting Institute.

Albert H. Streicher, formerly engineer with Foote Brothers Gear and Machine Corp., is now chief inspector at Industrial Spring Co.

Another business change is **Charles W. Thorson's.** Mr. Thorson is now an engineer with Laclede Arch Co.

Two former student members who are hard at work are **Edmund Valonis,** an engineer at Inland Steel, and **Frank Valvoda,** an electrical designer, with Verne E. Alden Co.

Dr. Gustav Egloff addressed the Third Annual Chicago Area Career Conference on the subject "Chemistry as a Career." Dr. Egloff was chairman of the Committee on Cooperation Agencies of the Conference. He also spoke in the interest of the Career Conference over Chicago radio stations WMAQ and WJJD.

Obituaries

Clarence C. W. Arnold, a member of Western Society of Engineers since 1947, was killed in an automobile accident last September. Mr. Arnold, just 43 years old, at the time of his death, was district maintenance engineer, the Illinois Division of Highways. Mr. Arnold had been post engineer with the U. S. Army for five years during World War II.

Educated at the University of Illinois, he received his B. S. degree in 1925. He was a member of the Society of American Military Engineers, and active in Western Society.

Mr. W. H. Bettle, a member of Western Society since 1920 and a life member since May, 1950, died on December 17, 1950, at the age of 70. At the time of his death Mr. Bettle was engineer of gas measurement for the Public Service Electric & Gas Co. of Newark, New Jersey.

Mr. Bettle received a B.S. in Mechanical Engineering from Haverford College, Pennsylvania, in 1899. At one time in his engineering career, he was associated with the Peoples Gas Light & Coke Co. in Chicago, as assistant superintendant of meters.

Another of the younger members who died recently, was Robert R. Brunke who passed away on December 2, 1950. For 22 years Mr. Brunke, who was 47 years old, had worked for the Illinois Bell Telephone Co., serving in many engineering capacities. At the time of his death, he was an engineer in the Central Office Planning Section. He had been a WSE member since July, 1948.

Revolution in Railroad Motive Power

As PRESENTED BEFORE WSE, October 9, 1950
By A. H. CANDEE,
TRANSPORTATION ENGINEER,
WESTINGHOUSE ELECTRIC CORP.

Railroad motive power is undergoing a metamorphosis, with the steam locomotive being replaced rapidly in many countries by the more economical diesel electric locomotive. In addition to this recently developed locomotive, which has fully proved its economy and reliability, a large amount of money and of thinking is being expended on other new types which hold promise of being even more economical than diesel electric power.

It was very fortunate for the United States that the diesel electric locomotive reached its maturity during the recent war, because its improved traffic handling characteristics made it possible for the railroads to carry, without faltering, the greatest load ever imposed upon any transportation system in the history of the world. Now, with costs constantly advancing, the diesels prime advantage (that of reducing expenses) has proved to be the salvation of many railroads. Pinched between high and still rising labor and material costs on the one hand and a tariff structure fixed by the Interstate Commerce Commission on the other, little margin exists to provide the funds necessary to keep the railroads in healthy financial condition. Since approximately 40 percent of the operating costs of a railroad are affected by the type of power used for moving its trains, it is natural to find the railroads turning to a locomotive which is superior to steam power for the handling of trains, for the maintenance or improvement of schedules, and from the standpoint of fuel and repair costs.

Until early in this century, the railroads had little choice as to the type of motive power which they could use because the steam locomotive was the only practical device for the propulsion of trains. Although electric traction was in limited use for street railways and elevated railroads, subways were virtually nonexistent because steam power underground was not practical. The rapid development of electric equipment for transportation purposes soon offered the railroads a second practical type for train movement and many railroad operations were electrified with trolley or third rail power systems during the period 1905 to 1940.

World War I and the years immediately following saw an intense development of the gasoline burning internal combustion engine. Railroads investigating its possibilities as a prime mover for rail transportation saved millions of dollars by purchasing gasoline electric railcars during the period from 1925 to 1930. These were for use on branch lines which, at that time, had not experienced serious competition by highway vehicles.

While this was going on, the diesel engine was being developed and groomed to take its place in the transportation motive power field. The outstanding performance of diesel electric railcars and locomotives, as well as the relative economy of their operation as compared to steam and gasoline electric power, have resulted in a broad adoption of this form of motive power in preference to steam.

With the advent of the system fed electric locomotive and later of the diesel electric locomotive, steam locomotive developments took upswings to meet the threatening competition of these new forms of power. Amid the present activity toward the improvement of diesel electric, gas-turbine electric, and system fed electric locomotives, some interesting developments of steam locomotives have been in progress.

One thought may be of interest. The wide use of diesel electric locomotives has impressed the railroads with the advantages of electric motor drive of

Figure 2: This six motor locomotive is exceptionally useful for heavy pulls. Streamlined appearance is secondary to visibility.

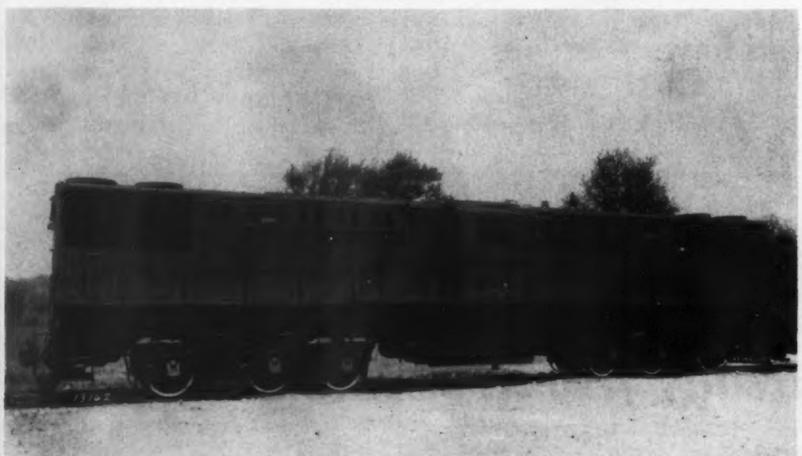


Figure 1: Artist's drawing of new 4500 hp non-condensing steam turbine electric freight locomotive. Work is now in progress.

the axles. It is probable that whatever motive power may ultimately emerge as the preferable type from this intense development activity will have electric power transmission to the driving axles.

Reciprocating Steam Locomotives

Developments in reciprocating steam locomotive designs have been in the direction of increased capacities, higher availability, and lower repair costs. There has been a general acceptance of higher steam pressures and superheats, of the roller bearing for driving axles, rods and pins, of the multiple throttle, of the thermo-syphon or circulator, and of feedwater heaters and exhaust injectors. The modern 4-8-4 steam locomotive has been of considerable importance to the railroads, especially during the war, because of its power and adaptability for either fast freight or passenger services. The Mallet locomotive has been improved greatly in efficiency and cost of operation. Advances such as these, while not particularly startling, show a healthy forward trend in the designs of reciprocating locomotives.

An advance of a more spectacular nature is the 4-cylinder rigid frame locomotive now in regular operation with a 4-4-4-4 wheel arrangement for passenger work and a 4-4-6-4 wheel arrangement for freight service. While one of the basic reasons for designing with four cylinders is to reduce crankpin stresses for high power output locomotives, many other advantages accrue from such an arrangement, among which are lighter reciprocating parts, reduced track stresses, better steam flow, reduced machine friction, and the possible use of smaller wheels which in turn allows boiler sizes to be increased.

Modern reciprocating steam locomotives are approaching the practical limits in reciprocating engine drive for rigid frame locomotives, for there is a rather definite maximum horsepower which can be utilized at the driver rims. This maximum is determined by the weight on drivers and the effective adhesive factor between wheels and rails at various speeds. To utilize more horsepower, there must be more weight per axle or more axles, but to build too many axles into a rigid frame lengthens the rigid wheel base beyond acceptable limits. It is probable that further increases in reciprocating steam locomotive capacities will be accompanied by changes in wheel grouping.

Steam Turbine Locomotives

The advent of the steam turbine locomotive on American rails late in 1944 was, in itself, proof that the railroad executives and equipment manufacturers are ever receptive to the possibilities of improving motive power. The first locomotive to use direct drive by means of a steam turbine in the United States was built by Baldwin-Westinghouse for the Pennsylvania Railroad and employs a gear transmission. It operates non-condensing and has been assigned for the most part to services west of Pittsburgh, Pennsylvania. This engine has not proved particularly successful, chiefly because it employs mechanical drive, which still retains the rising horsepower characteristic of the conventional reciprocating type steam locomotive and is also limited in number of driving axles. This locomotive has a 6-8-6 wheel arrangement with a forward and a reverse turbine located between the middle pairs of drivers and geared to the two adjacent axles. The drive of the outer axles is by side rods. The turbines are located outside of the locomotive frames just under the boiler, where they are accessible. The forward turbine develops 6900 horsepower and

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Figure 3: This single unit gas turbine electric locomotive uses liquid fuels in each turbine. Work was not completed until 1950.

Revolution In Railroad Motive Power

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is permanently geared with a ratio of 18.5 to 1 for a maximum locomotive speed of 100 miles per hour. The reverse turbine is geared through a clutch, with a ratio of 75.4 to 1 to allow a maximum reverse speed of 25 miles per hour.

The gearing is housed in an oil-tight gearcase supported on the locomotive frame, the two turbines are supported on this gearcase. Since relative movement takes place between the frame and axles, the gears drive quills surrounding each of the two driven axles, and tractive force is transmitted to the driven axles by means of flexible drive. The two additional pairs of drivers are driven through side rods, the whole assembly of turbines, gears, and side rods thus being of rotational character and may be accurately balanced for all speeds.

It is obvious that the number of axles which may be driven by mechanical drive (gears) from a single turbine is limited. For a high capacity locomotive, especially for freight work, it is desirable to drive at least six and preferably eight axles. These considerations led the Chesapeake & Ohio Railway to install three coal burning steam turbine electric locomotives in 1947. These locomotives are of Baldwin-Westinghouse design, with a boiler pressure of 300 pounds per square inch and use single 6000 horsepower non-condensing steam turbine driving generators. These supply electric power to eight traction motors, each geared to a driving axle. Although especially suitable for freight work, because of the number of driven axles, they were originally geared for and used in passenger service.

The locomotive operates in what is normally considered a reverse direction, with the streamlined coal bunker, built as an integral part of the locomotive, ahead of the firebox and the conventional fire tube boiler back of the firebox, stack to the rear. The turbine-generator set is mounted on a platform immediately behind the smokebox, and a water-carrying tender is coupled behind the motive power unit. The locomotive has a 4-8-4-8-4 wheel arrangement with axles 3, 4, 5, 9, 10, 11, 13 and 14 driven by motors. While some reduction in weight on the forward driving axles occurs as coal is consumed, there is not sufficient variation to cause concern as to wheel slip. The economies of these units are not high enough to expand their field of usefulness because of high turbine back pressures occasioned by the method of drafting.

The attractiveness of steam turbine electric locomotives increases as the coal consumption and repair expense decrease. Little can be accomplished in this direction as long as the conventional firetube boiler is employed and exhaust steam is used for drafting. It has been found that with this type of drafting, high turbine back pressures are difficult to avoid, and that these affect the locomotive efficiency to a marked extent. Work is now in progress on a new 4500 horsepower non-condensing steam turbine electric freight locomotive for the Norfolk and Western Railway which will have a new watertube boiler operating at a pressure of 600 pounds per square inch and with a steam temperature of 900° F. Mechanical drafting will be employed, permitting the turbine to exhaust to approximately atmospheric pressure. The overall locomotive efficiency is expected to be such that the coal consumption will be approximately 50 percent of that of the conventional reciprocating steam locomotive. This locomotive, which is being developed jointly by the Baldwin Locomotive Works, the Westinghouse Electric Corporation, and the Babcock & Wilcox Company, will have a 4-8-4-8 wheel arrangement, with all axles motored. The locomotive is being built to a loaded weight of 711,000 pounds, all of which will be on the 12 driving axles, thus allowing a maximum starting tractive force of 177,500 pounds at 25 percent adhesion. The continuous tractive force rating, as defined by electrical considerations, will be 125,000 pounds with gearing which gives maximum allowable traction motor revolutions (peripheral speeds) at 60 miles per hour. (Figure 1).

Diesel Electric Locomotives

Diesel electric locomotives, as applied to the major railroad operations of the United States, have been semi-standardized in the interests of mass production and low costs. The engines which are used for these are very reliable, continue to put out rated power over long operating periods and entail a minimum of repair expense. Built in sizes from 600 to 2400 horsepower (net for propulsion purposes) they have been installed on a variety of locomotive units. When high horsepower is necessary in order to handle trains, this is normally secured by assembling the required number of units and operating them in multiple, this procedure applying particularly to units having engines of 1500 horsepower or more.

Diesel electric switching locomotives

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are now accepted as being the most satisfactory and economical type of motive power for yard switching work in the United States. While there are still large numbers of steam switchers in use, it is only a question of time until most of them will be scrapped. Diesel electric road freight and passenger locomotives are being applied in increasing numbers because of their economical performance and superior characteristics for hauling trains. Developments in this type of motive power consist, primarily, of improvement of details such as up-rating of existing engines, improvements in electrical insulating materials, developments in lubricating oils, greases and practices, simplification of locomotive auxiliaries, and standardization of locomotive subassemblies, (such as trucks, cabs, underframes, hoods, etc.) so that a variety of sizes and arrangements may be constructed from a minimum number of standard components.

The road switcher type of locomotive is a very versatile unit for many of the smaller railroads, who find it economical to use such a locomotive for road freight or passenger trains and then to improve its utilization by assigning it for yard or industrial switching work when not in road service. The construction of these is similar to that of a modern diesel electric switcher, having an operator's cab and a hood over the engine, but with a hood type compartment back of the cab for housing a steam generator when necessary. Since such locomotives are not usually operated in multiple, a streamlined appearance is of secondary importance to the excellent visibility afforded by the hood type of construction. The arrangement of apparatus under the hood is similar to that of diesel switching power. When 3-axle trucks are used, with a motor driving each axle (six motors per locomotive) an exceptionally useful locomotive for heavy pulls is obtained. (Figure 2) This type of locomotive is gaining increased popularity. When more power is needed in addition to the increased tractive force resulting from the use of six driving axles, engines having a total capacity of 2000 to 2400 horsepower are used.

The period from 1925 to 1930 saw the development and application of hundreds of gasoline electric railcars on the American railroads. With the passing of the gasoline engine and the rise of the diesel engine as the accepted prime mover for rail propulsion purposes, large motive power demands were so immediate and insistent that the rail car was shunted to the background in favor of the locomotive. Lately, however, a revival of interest in railcars has been noted and it may be expected that the next few years will see a limited number of such applications. The Budd Company is now demonstrating a double truck railcar designed primarily for suburban service. This has two 275 hp, 1800 rpm diesel engines mounted under the car floor, each engine driving one axle of the adjacent truck through a fluid coupling while the car is accelerating and then by direct drive over the higher range of car speeds. This development is being watched with interest, inasmuch as similar engine locations and types of drive have been tried previously without particular success. If found practical, this will offer the first serious challenge to the electrical transmission system for diesel engine driven vehicles, which has been the accepted standard for diesel motive power and which has been responsible for many of the advantageous operating characteristics of these units.

System Fed Electric Locomotives

While there have been no major trolley or third rail electric installations made in North America in recent years, there has been, and still is, considerable development activity which presages an expansion of this method of supplying propulsion power. A committee is now at work studying the problems of railway power distribution. This study will result in substantial reductions in the cost of electrification systems and of system fed electric locomotives, thereby promoting still further advances in this field.

One important development of the war which may be considered as an improvement in equipment for electrification is the Ignitron. This device of the mercury arc rectifier family was widely used during the war to convert alternating current to direct current for the production of aluminum. The Ignitron can be used for very efficient conversion of power from multiphase power sources at commercial frequencies to direct current for application to trolley or third rail systems, and reduces the installation expense for such systems. However, developments during the past 18 months have destined the Ignitron to play a much more important role than that of a wayside power conversion device—it has been promoted to a key position on the locomotive itself.

As far back as 1913, Westinghouse equipped a car with direct current traction motors and a mercury arc rectifier, operating this car for over 22,000 miles by power received at 11,000 volts, 25

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cycles from the trolley wire of the New York, New Haven and Hartford Railroad. While it performed with reasonable success, three major difficulties were encountered: faulty arcing within the rectifier, excessive electrical interference in telephone lines adjacent to the track, and difficulty in maintaining vacuum within the rectifier. These indicated that the rectifier needer further development before being suitable for transportation purposes. The invention of the Ignitron in 1932 and the wartime pressure for improvements in manufacturing processes have resulted in a rectifier of a type which may now be used on railway vehicles.

The Ignitron is a water cooled metallic vacuum tube having a graphite anode located at the top of the interior, a pool of mercury at the bottom which forms the cathode, and a timed igniting arrangement for initiating an electric arc at the mercury pool. With alternating voltage impressed upon the anode, electric current will flow through ionized mercury vapor within the tube as long as the anode voltage is positive with respect to that of the cathode. Current will not flow in a reverse direction, so that when the anode voltage reverses, the current flow ceases and the arc which sustains the flow is automatically extinguished. Thus, current can flow during but one-half of the alternating cycle, and this flow has to be reestablished each cycle by first striking an arc by means of the timed ignitor. If two banks of Ignitrons are used, each half of an alternating current wave may be utilized, so that a variable direct current is obtained.

In addition to the fact that the Ignitron rectifier locomotive offers advantages in improved efficiencies, lowered repair expenses and reduced installation costs, the prospects for trolley electrification are better than they have been for some time. Whereas traffic density has been considered the criterion for determining the economies of electrification, the persistent increases in wage rates have given rise to serious thought as to ways and means of reducing the labor content of railroad operating costs. In this respect, the system fed electric locomotive offers the greatest relief, since the labor required for its operation and repair is lower than for any other known type. Moreover, power costs have been stable and in some cases have had a downward trend, while both liquid and solid fuel prices have been advancing. It is probable that the future will disclose a rise in the number of trolley electrification projects.

One type of system fed electric locomotive now in use by a western open pit copper mine has a diesel engine as an auxiliary source of power. Trolley power is used for all operations except at the working faces (or benches) of the mine where a contact system would be hazardous and expensive. For the bench operations, then, the diesel engine-generator set furnishes the electric propul-

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sion power. Previous locomotives in this same type of service employed a battery for self-propulsion but these batteries are being replaced by diesel engines because of the high cost of maintaining the batteries.

Gas Turbine Electric Locomotives

One of the most interesting motive power prospects is the gas turbine electric locomotive. Its development hastened by the last war, the gas turbine seems now to have wide commercial possibilities, and it is only natural that alert railroad executives and locomotive builders should endeavor to adapt it for railroad propulsion within its economic range. As a result, there is considerable activity toward perfecting it for this purpose.

In its essentials, the gas turbine operates somewhat like a steam turbine except that instead of steam, the gaseous products of combustion of a fuel are passed to the blades of the turbine rotor under pressure, thereby converting part of the energy contained in these hot gases into useful work. The problem is not quite that simple, however, for the products of combustion are too hot for existing metals and must, therefore, be cooled to a temperature which the turbine blades will withstand. This is done by mixing a large quantity of air with the hot gas, and this large quantity of air at the desired pressure takes a large compressor and considerable power. Also, since one of the chief advantages of the gas turbine prime mover is the absence of reciprocating parts, the compressor is preferably of the rotary type. The essentials of the gas turbine prime mover, then, are a combustor for burning fuel and generating a supply of hot gas under pressure, a rotating compressor, and the turbine itself. Other economy devices can be added to improve the efficiency and probably will be later, but most of the developments now under way are employing the bare essentials to establish the practicability of the gas turbine for railway purposes.

The natural fuel for a gas turbine is a liquid fuel, probably a heavy grade of oil at relatively low cost. Such a fuel results in simple means of introducing and controlling the supply. However, there is a group of engineers sponsored by the bituminous coal industry who have been engaged in the development of means for utilizing pulverized coal as a fuel for gas turbine locomotives. As a matter of fact, this group some time ago placed an order with each of two manufacturers for 3750 hp machines designed to burn powdered coal, but no locomotive has appeared as yet to demonstrate its practicability. Some engineers question the advisability of superimposing one major experiment on another, since the pulverizing of coal and the handling of this powdered fuel in themselves have not yet been satisfactorily solved for locomotives.

The Westinghouse Electric Corporation has constructed a single unit, 4000 horsepower gas turbine electric locomotive which weighs 240 tons and is mounted on four 2-axle swivel trucks with traction motors driving all axles. Power is generated by two 2000 horsepower (net for propulsion) turbine-generator sets mounted opposite each other in the locomotive with a center aisle. Each turbine rotates at a maximum of

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Revolution In Railroad Motive Power

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8750 rpm, uses liquid fuels, and drives electric generating equipment through a reduction gear, interposed between the rotary compressor of the prime mover and the main generators. The development work on these power plants was initiated in 1945, but exhaustive tests on the test plant were preferred rather than making these on the locomotives, which delayed the completion of the locomotive until early in 1950. (Figure 3)

The construction of the locomotive embodies a radically new feature. Because of the experience with diesel electric locomotives, it was decided to mount the body of this locomotive on swivel trucks. In previous designs, where four swivel trucks are used, pairs of trucks have been mounted under subframes and the body of the locomotive then carried on two centerpins, one located on each of the two subframes. The Westinghouse gas turbine electric locomotive has no subframes, and each truck carries its share of the body weight directly. The trucks are of the swivel type, but since the two inside trucks must move sideways relative to the body when rounding a curve, the centerpins cannot be fixed in their location with respect to this body. The solution is to mount a swiveling centerplate on top of the centerpin of each truck and carry the body weight on rollers in this plate which is restricted in a longitudinal direction but is free to move transversely. The transverse movement of the end trucks is then restrained by stops (built as part of the body structure) acting against leaf springs at the sides of the truck centerplates to limit their movement to 2½ inches in each direction. The intermediate trucks do not have this restraint and are free to move sideways as far as necessary, although there are stops provided at the safe limits of transverse movement. This type of construction reduces the weight and cost of the mechanical structure.

With a relatively long body mounted directly on four individual trucks, the weight may not be evenly distributed on each of them when rolling through vertical curves or on an irregular track if conventional truck designs are used. By providing springs with long deflection, however, this inequality has been reduced to a small percent, even under extremely poor track condition or sharp vertical curvatures.

The gas turbine is in its infancy and a great many of its operating characteristics are unknown. Life of blades, of combustors, and of nozzles in normal railway operation are undetermined, yet short life of these parts may easily cause repair costs to be high. Warping or distortion of parts due to rapid temperature changes or to shocks incident to locomotive operation can only be gauged by extensive service on rails. Some factors are known, such as wide variations in horsepower output due to atmospheric temperature changes and elevation above sea level, but in general there is a great amount of testing to be run out before the railroads can accept this type of prime mover as a reliable and economical member of the motive power family. Westinghouse engineers plan to use liquid fuels during this period of development, but are experimenting with the preparation of solid fuels.

The gas turbine rotor has high output for its size. However, a rotary compressor (as normally used for supplying combustion and cooling air) is extravagant and uses a large proportion of the output of the turbine. Thus, the turbine of a 2000 horsepower (net) plant actually generates somewhere around 6000 horsepower, 4000 of which is used to drive the compressor. This normally means relatively high fuel consumption, especially at reduced loads or when idling, and has given rise to many ideas as to less wasteful means of generating gases of combustion at the correct temperatures and pressures for use directly in the turbine. The Lima-Hamilton Corporation took a contract for a gas turbine electric locomotive using a 3200 horsepower Westinghouse gas turbine and electrical equipment and are developing a free piston gas generator to supply the hot gas for the turbine. In principle, this is an opposed piston diesel engine without crankshafts, and with the opposing piston assemblies geared together through racks and a pinion so that they will synchronize. The power pistons are forced together, air is compressed, and liquid fuel is injected and burned as in a diesel engine. The expansion stroke is similar, but when one

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of the pistons has traveled a fixed distance, a port is uncovered and the gases of combustion (still under pressure) enter a receiver on their way to the turbine. In the meantime, larger pistons which are carried by the power pistons are compressing air which is used to scavenge the power cylinders to a receiver at the necessary pressure. At the remote end of each piston assembly is a "bounce" piston, whose function is to compress air at a high enough pressure during the expansion stroke to bounce the piston assembly back to the firing position against the compression pressure in order to repeat the cycle. This development has considerable merit and, if successful, should result in much higher overall gas turbine power plant efficiency.

Conclusion on Future of Rail Engines

The subject of development does not rightfully cover a prognostication of the probable field of application for each of the various motive power types now or soon to be available for railway propulsion. Nevertheless, it appears that the importance of such developments may be better gauged if an opinion is expressed as to the economic future for different types of locomotives.

Steam locomotives have held a dominant place for North American rail propulsion in the past, but now seem to have met some very serious rivals. It is true that the diesel electric locomotive has shown considerably better performance in switching service than steam, and for most other services it has decided advantages. However, it is believed that modern reciprocating steam power, if utilized more intensively than has been the past practice and with modern maintenance facilities comparable to those provided for diesel electric locomotive operation, could have a definite place in American railroading for many years to come. The high pressure, high superheat steam turbine electric locomotive has excellent prospects in the motive power field.

The diesel electric locomotive is a practical and efficient machine. Its future in the switching and lighter traffic field is virtually assured, and for the heavier work its characteristics are often of considerable advantage over steam because of the multiplicity of driven wheels and also because it develops constant horsepower output over a wide range of train speeds. While it may have to share the high power locomotive field with the gas turbine locomotive at some later date (because of the apparent necessity of using a multiplicity of diesel engines for larger power concentrations), there is still a wide field of application in all types of service. The proved economies of this type of motive power make it safe to continue purchases of such units, even in the face of the higher economies expected of the steam turbine and the gas turbine electric locomotives.

The system fed electric locomotive will always have a place in American transportation, since single locomotives may be constructed to produce almost any power output needed for fast and heavy freight and passenger work or for limiting grade operations. The rising costs of labor and the trend toward stabilization or reductions in cost of electric power, also the expectation that the Ignitron will permit the use of commercial freqeuncies for locomotive power supply, promise further expansion of these systems of propulsion.

The future of the gas turbine electric locomotive is still unknown. It has its advantages and its faults. However, considerable expense is being incurred toward removing the disadvantages now recognized, and many engineers are working to improve its efficiency. It is probable that, when perfected, it will have a definite place in the motive power field in capacities of 1500 horsepower and upward and may physically replace diesel engines now installed and running.

Fuels for rail transportation purposes are causing considerable discussion and research work. The basic fuel of the United States is coal, but we have had a taste of the convenience of liquid fuels and will always use these as long as they are readily obtainable unless considerably improved economies of solid fuels are fully demonstrated. It is expected, of course, that liquid fuels will be made from coal when and as the supplies of petroleum near depletion. Thus, the

(*Continued on Page* 24)

ASME Announces February Meetings

"High Speed Passenger Train Brakes" will be the topic of Carl E. Tack's talk, on Tuesday, February 6, at 7:30 p.m. in the WSE large auditorium. Mr. Tack is assistant chief mechanical engineer of the American Steel Foundries Company. This meeting, sponsored by the ASME Juniors will be preceded by a movie, "Power to Stop," in sound and color.

On the 19th of February, ASME will join WSE and the other founder societies in presenting the 1951 Washington Award to Edwin Armstrong, at the Furniture Club of America.

The Railroad Division of the ASME has invited Oscar C. Maier, director of research, Pullman Standard Car and Mfg. Co. to speak on "Research and Development Policy and Administration," on February 20, at 7:30 p.m. There will be a rendezvous dinner at 6:15 in the WSE dining room.

Carson's Georgian Room will be the setting for the Women's Auxiliary luncheon meeting on February 23, at 11:30 a.m. Betty Barton Greco will present "Jewels of Romance," a talk on the famous diamonds of the world, and will show her equally famous collection of replicas.

Truck Company Gives Safe Driving Hints

Appalled by the death in 1950 on the nation's highways of six times as many Americans as lost their lives in five months of fighting in Korea, United States truck drivers have come up with a set of "rules drivers live by, violators die by."

They set the rules down in a highway safety essay contest sponsored by Fruehauf Trailer Company. The drivers offer them in the hope they'll enable some of their fellow highway users to live to see the end of 1951:

Don't "tailgate" drive so close to the car ahead you can't stop if that car must, or so close that a car passing you can't get back into the right hand lane if danger suddenly appears.

Park all your problems—financial, domestic or any other type, at the curb when you pull away from the curb.

Drive defensively rather than offensively—assume always that the other driver is going to do something foolish, is about to disregard all safe-driving practices and ignore traffic regulations, and has his heart bent on risking his own neck and yours.

Never debate the right-of-way, give it.

Remember that your car will do only as you bid—if you are the master.

Never be too lazy to lift your foot from the gas to the brake the instant you see any potential danger—it may become a real danger.

Never plan in advance exactly how many miles you must cover in a given time, gear your driving to the highway and to traffic.

Don't "overdrive" your lights and brakes.

If you must stop on a highway, stop *off* of it.

Be ever willing to "go the second mile" in courtesy, remembering that you can *live* by the three C's of safe driving—care, courtesy and common sense.

Accept traffic laws and regulations in the spirit in which they are intended—as aids, not harassments.

Don't try to keep up the pace set by a "horse" larger than you are driving.

Be conscious of your vehicle's position on the highway, whether moving or parked.

Never fight sleep at the wheel—surrender to it off the road.

Know the condition of your car and its equipment. A-1 equipment represents a start toward A-1 safety.

Remember that patience will go a long way toward keeping everyone safe and alive on the highway.

Board Appoints 1951 Nominating Committee

To the Corporate Members:

I am pleased to announce that in accordance with Article X, Section 3, of the Constitution, the Board of Direction has appointed a Nominating Committee as follows:

Gustav Egloff, 310 S. Michigan
Chas. B. Burdick, 20 N. Wacker
E. Gordon Fox, 109 N. Wabash
L. C. Gabbard, 208 W. Washington
B. A. Gordon, 1 N. LaSalle
John P. Gnaedinger, 525 N. Noble
L. E. Langdon, 4241 Ravenswood

The Constitution also provides that suggestions for nominees shall be solicited in the publications of the Society.

J. EARL HARRINGTON
Executive Secretary

Tear Off and Return

To the Nominating Committee, W.S.E.

I suggest the following names for consideration by your committee for offices indicated.

Officers and Trustees

President ....
1st Vice Pres.........................
2nd Vice Pres.........................
Treasurer ....
Trustees (two to be nominated) ....

Members of Washington Award Commissions

Past Pres. of W.S.E...................
Members not a Past Pres. or at present a member of the Board or candidate thereof.....................

Signed ....
Address ....
Date ....

Dr. Karl T. Compton of M.I.T. Awarded Hoover Medal

Awarding of the 1950 Hoover Medal to Dr. Karl T. Compton, chairman of the Corporation of Massachusetts Institute of Technology, for "distinguished public service," was announced by Scott Turner, chairman of an award board representing the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Society of Mining and Metallurgical Engineers.

The award was made to the distinguished M.I.T. scientist as a "Great leader in engineering education, who has had a profound influence on the development of science and engineering, and has devoted himself wholeheartedly to the welfare of the nation, both in times of peace and in times of war. . ."

Dr. Compton is the twelfth engineer to receive the medal since it was first awarded to Herbert Hoover in 1930 to commemorate his civic and humanitarian achievements. Other recipients include Gerard Swope, Dr. Vannevar Bush and Dr. Frank B. Jewett. The medal was established through a trust fund created by a gift of Conrad N. Lauer and is awarded periodically to distinguished engineers selected by a Board from the four engineering societies.

A native of Wooster, O., and a graduate of Wooster College, Dr. Compton taught there and at Reed College before going to Princeton in 1915. He was research professor and chairman of the physics department when he left in 1930 to become president of M.I.T. He was named chairman of the Corporation of M.I.T. and chairman of the Research and Development Board of the National Military Establishment in 1948. He retired recently from the latter post because of ill health.

Members Eligible for Technical Paper Awards

Four award contests for papers of outstanding quality are open to Western Society members.

Younger members of WSE are eligible to compete for two awards honoring engineers, both of them granted for excellence of papers submitted. The subject is not restricted so engineers of all fields should be interested in competing.

Members who have not passed their 31st birthday are eligible to be considered for the Alfred Noble award, established in 1929 to honor the late Alfred Noble, Past-President of WSE and of the ASCE.

The award is made to any member of WSE and the four Founder Societies, for a technical paper of exceptional merit accepted by the Publication Committee of any of the five sponsoring societies for publication in one of its technical publications.

Each paper forwarded to the Joint Prize Committee must contain a brief synopsis: a statement of the paper's purposes, and a concise statement of its conclusions—unless this information appears in the paper itself. Papers by joint authors are not acceptable.

The amount of the prize, which is a cash award, and the contribution, if any, for payment of transportation expenses to and from the meeting at which the prize is awarded, are set by the Board of Direction of the ASCE, which administers the fund. The prize is accompanied by a certificate of award.

The recipient of the prize is selected by a committee of five, one from each of the participating societies, and the award is based on papers published by each society during the year ending June 1. The papers must be submitted to the Joint Committee by the society, not later than August 15, and must be presented in full even if published in abstract.

The award is made publicly by an ASCE representative at a general meeting of the society of which the recipient is a member.

Charles Ellet Award

Members of the Junior Division are eligible to compete for the annual Charles Ellet Award for the best semitechnical paper presented before WSE members.

Contestant will be judged both on the written paper and on the oral delivery, and the winner will be formally presented with the Charles Ellet Award at the annual WSE dinner meeting on May 29, 1950.

Established in 1929 by a gift from E. C. Shuman, a Junior member, the award is symbolized by a silver loving cup with each recipient's name and alma mater engraved thereon. This is displayed in the WSE headquarters. In addition to this honor, the winner receives $25.00 and an engraved Certificate of Award.

The paper should present a lay-treatment of a semi-technical subject. Objective but complete coverage, rather than complex formulæ and derivations, is desired.

There is no restriction or limitation on the choice of subject for this paper. Judging, however, will be performed by a 5-man award committee giving equal weight to each of the following five (5) points:

(1) Timeliness of the subject.
(2) Engineering application of the subject.
(3) Knowledge of the subject.
(4) Preparation of the paper.
(5) Presentation of the paper.

The paper should be typewritten, double spaced, less than 2,000 words and submitted in triplicate. Although submitted in writing, the paper must be presented orally, and not read verbatim, at the competitive meeting. Charts, diagrams or other visual aids which assist in the presentation of the subject should, of course, be used wherever necessary and should be incorporated in both the manuscript and the oral presentation.

All Junior members (28 years of age and under) are urged to file notice with the secretary's office and prepare a paper for this competition.

Cash Award Contest

The cash award paper contest is open to all Society members. Members can win prizes of $250, $150 or $100. This paper should not be highly technical but of general interest to engineers.

The Octave Chanute medal is awarded for the best papers presented before the Society. Section and program chairman should secure papers from the Monday night speakers.

Further inquiries concerning the awards should be sent to WSE Headquarters.

Markham Yards Gets A Face Lifting

(Continued from Page 8)

about 250 feet from the northbound hump office. The antenna for the station is located on top of the tower, 120 feet above the base. The radio equipment operates on the frequency modulation principle, with an assigned transmitter frequency of 161.85 megacycles. The Federal Communications Commission has assigned call letters WMWK to the land station, and WEHM to the mobile stations on the locomotives.

Red, green and yellow color light signals are maintained on the hump facing the humper engine. These signals are under the control of the hump foreman and are used to control the action of the hump locomotive engineer. These signals govern the speed of his train, and can be set to stop the humping at any time. Repeater signals have been installed midway in the receiving yard to afford the hump engineer a clear view of the signals at all times.

All yardmasters' offices and the general yard offices are equipped with automatic telephones. The automatic telephone exchange is located in the general yard office. The automatic telephones at Markham, by means of tie lines, connect with other automatic exchanges at Burnside Shops, 63rd Street Accounting offices and Central Station. There are also telephones installed throughout Markham Yard to enable the quick communication of information between supervising offices.

A modern mechanical terminal at the south end of the yard includes an engine house of 48 stalls, a double track deep water cinder pit 300 feet long with an overhead crane, a 1200-ton concrete coaling station, machine shops, store houses, carpenter shop and miscellaneous buildings. The terminal can handle about 150 locomotives every twenty-four hours. Provision has been made for the installation of an additional engine house and cinder pit for the future.

A modern car repair plant for handling bad order cars is located between the northbound departure and the southbound receiving yards. At present these facilities consist of 8 tracks, each track having a capacity of about 40 cars, and 4 stub tracks each having a capacity of 18 cars. The yard is equipped with overhead air lines for the operation of tools and other labor-saving devices used in the repair yards. Material is distributed with trucks that operate on concrete runways. The yard is provided with the most modern machinery available. It will ultimately accommodate 1200 bad order cars at one time.

Revolution In Railroad Motive Power

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diesel electric locomotive can be expected to remain a factor in railroading for many years to come.

One noteworthy fact emerges from the diverse motive power development activities which have occurred during the past 25 years—that the propulsion of rail vehicles by electric motors has capabilities and advantages unsurpassed by any other form of drive. Smooth exertion of tractive force and power application, high utilization of available prime power, distribution of power to an unlimited number of driving axles, simple running gear normally associated with traction motor drive, and similar inherent characteristics make electric drive hard to equal. It is expected that locomotives under development or which may be constructed in the future, will have electric drive as one of the basic features of their design. This prediction results from the present operation of somewhere around 16,000,000 traction motor horsepower on the railroads of North America.

The locomotive of tomorrow is the electric locomotive, whether receiving its power from a trolley, a steam turbine, a diesel engine, or a gas turbine.

Find Outlook Bright for Engineers

Radically new policies in industry are resulting from the current shortage of graduating engineers.

The results of an ever-increasing demand for engineering graduates—a complete reversal from the widely-heralded overabundance of last June—were cited recently by Raymond D. Meade, placement director at Illinois Institute of Technology.

As liaison between industry and graduating seniors in the engineering college, Meade's department has placed more than 4,000 graduates in the past four years.

"It is certain that engineering colleges cannot meet the complete demands of industry at the present time, and it appears that they will fall even farther behind in the future," Meade said.

This has brought about some unusual trends. Ten more noticeable effects of the abrupt turn-about are:

1. More companies are interviewing prospective graduates in the colleges than ever before.
2. Salary levels for beginning engineers have increased at least 10 per cent in the last four months.
3. No graduate is beginning at less than $275 a month, and last week a company offered $500 a month for a qualified electronic engineer with a bachelor's degree. The average is $290 to $310.
4. Industry is seeking women engineers for the first time.
5. Any engineering graduate can begin work the day after graduation.
6. Engineers in sales work and service operations in industry already are being channeled into strictly engineering functions.
7. On-the-spot hiring is taking place for the first time.
8. Research managers and heads of engineering departments are accompanying personnel men who normally interview, evaluate, and refer applications.
9. Companies are willing to accept men who are eligible for the draft if they have not received their first notice.
10. Training programs have been curtailed and eliminated except in the largest companies, and graduates are being placed immediately in engineering work.

The placement picture began changing last September. Between September 15 and October 15 demands for research, development, and design personnel increased at a surprising rate, Meade said.

"Between November 1 and December 1 calls for production men became urgent, and the entire thing has snowballed ever since. There have been as many inquiries in the past three weeks for production men as there were during the entire period from September 1 to December 15."

The drop-off in enrollment in engineering colleges will produce an alarming shortage that already is being felt, and this is only the beginning, Meade asserted.

The low birth-rate of the '30's now being felt in the high schools and selective service demands upon man-power will heighten the shortage.

WSE Applications

118-82 R. J. Eisler, Consulting Engineer & Associate, Charles Lerch & Associates, 141 W. Jackson Blvd.

119-82 Kenneth F. Wright, 1000 S. Prospect Ave., Park Ridge, Ill.

120-32 Fred G. Benner, Instrumentman; Chicago, Milwaukee, St. Paul & Pacific Railroad, 2599 W. Grand Ave.

121-82 Ralph G. Raymond, General Sales Manager, Commonwealth Edison Co., 72 W. Adams St.

122-82 Ralph E. Jochim, Jr., 6315 N. Artesian Ave., attending Illinois Institute of Technology.

123-82 Robert W. Richter (Trsf.), Field Engineer, Intrusion-Prepakt, Inc., 80 E. Jackson Blvd.

124-82 Edgar J. Karpus, 3446 W. Evergreen Ave.

125-82 John M. Ammerman, Director of Engineering, Pressed Steel Car Company, Inc., 6 N. Michigan Ave.

126-82 Melvin L. Polacek, Resident Engineer, City of Chicago, Division of Bridges, R-1001, City Hall.

127-82 Daniel J. Love, 2055 W. 51st St., attending Illinois Institute of Technology.

128-82 George C. Gallagher, Jr., attending Illinois Institute of Technology.

129-82 Leith Johnston, Staff Engineer, Automatic Electric Co., 1033 W. Van Buren St.

130-82 Herbert F. Wustmann, Regional Engineer, Structural Clay Products Institute, 228 N. LaSalle St.

Employment and Advancement Opportunities for Engineers

(Continued from Page 4)

engineers today, with the draft going on the shortage may well become far more acute.

What is wanted in research and development is to find new ways to do old things and to do new things. A higher degree will help an engineer to accomplish this task at least as far as research and development are concerned.

"Although the higher degrees in engineering point toward increased income and other satisfactions, one must not take for granted that a degree gives any rights to coast along or that it makes a good engineer out of a man. Ability is still the cardinal factor in the profession of engineering."

The final speaker, Mr. H. P. Sedwick, vice-president of the Public Service Company of Northern Illinois and president of WSE, spoke from the standpoint of the engineer in management.

When a company like Mr. Sedwick's hires an engineer it hires itself a manager at the same time.

Management experiences several major problems with respect to engineers. First, management must develop the engineers with latent abilities for general executive positions. Next, management must encourage contacts and activities that will broaden the engineer's understanding of the management problem. The engineer must learn the business, especially that outside of engineering, if he is to develop and grow in industry. He needs curiosity, and he must be bigger than his job by gaining a wider acquaintanceship with community affairs and with engineers in other companies.

Engineer training is the finest background there is upon which to develop leadership in almost any kind of a business, and certainly in one with an engineering interest. But there is a definite demarkation between what the engineer did in school and what he does when he gets out. While in school, his thinking is specialized. When he gets out he must broaden his objectives, whether his career is one in specialized engineering or in management.

Engineers, to get better opportunities in business today, need to recognize the fact that a technical job is not an 8-hour day, 5-day week. They should be willing to work for the love of it, and have a mission in their job.

Book Browsings

Books Available at WSE Headquarters

Art of Making Castings

Precision Investment Castings, by Edwin Cady. Reinhold Publishing Corporation, New York, 1948. 356 pages. $6.00.

In the development of the art of making fine castings, the materials for forming the molds became known as clothing for the castings. The old English word "investment," meaning specially prepared clothing, is retained as a trade term. Another early development was the use of a wax pattern for making a ceramic mold from which the wax could be melted. Such a dispensable pattern, which may be made of other similar material as well, is the distinguishing characteristic of the precision investment casting process with which this book deals.

In the early 1930's the idea of making duplicate dispensable patterns, so that many parts could be cast exactly alike, was developed. This was the beginning of precision investment casting as an important industrial process. However, it is so little understood that it was called upon to do the impossible while thousands of cases to which it is particularly suited are not presented. The author estimates that it could be profitably used in $5,000 production plants serving 100,000 manufacturers.

The process is able to complete intricate work which could not otherwise be done or to do it more economically than by other methods. It is frequently a complicated process requiring many operations demanding skill and scientific knowledge. The author deserves great credit for the thoroughness of its presentation. The reader will be amazed at its many ramifications and may find that the process offers direct advantages.

E.B., W.S.E.

Elementary T-V Service Tips

Television Servicing, by Walter H. Buchsbaum. Prentice-Hall, Inc., New York, 1950. 340 pages, $5.35.

This book, as the title indicates, is written for the television receiver technician or serviceman. It covers the elementary principles of television systems, and the purpose, function and analysis of receiver circuits. The latter is by separation of the circuits into fundamental parts, based on the purpose of each part.

Antennas, lead-in lines and installation are discussed, with some pointers on possible failures and trouble-shooting. It is written in practical style with many references to commercial models of receivers. This book should be of interest to television receiver owners who want to learn something about how their receivers operate, and it may provide some ideas for improvement of reception.

W. F. L., W.S.E.

Air Transport Improvements

Human Factors in Air Transport Design, by Ross A. McFarland. McGraw-Hill Book Company, Inc., New York, 1946. 670 Pages. $6.00.

Designers and builders of aircraft will find much worthwhile material in this book; likewise, operators of aircraft, and makers of aircraft equipment. It is an exceptionally full and meaty book, containing some illustrations, and many tables and charts. Seldom is such extended research chronicled for public perusal. This probably can be credited to the basic importance of, and large public interest in, the subject. The book is quite readable as a continuity, but will have the greatest field of usefulness as a reference book.

Each chapter is virtually a treatise on one subject, combining the author's extensive researches of technical, physiological, and psychological literature with the results of his own scientific researches to fill the gaps in previously established knowledge, and ending with definite conclusions and a bibliography. Among the aspects which definitely affect human welfare and the ability to take long plane rides, the author discusses pressurization, ventilation, air-borne pests, carbon monoxide, noise, vibration, motion, flight performance, and accidents caused by neglect of human factors. There is a long chapter on crew space and working conditions, and one on passenger accommodations. There also is a rather complete index.

This book was written with the avowed purpose of promoting the improvement of aircraft, both civilian and military. The author can visualize much greater popular acceptance of the former, and much more effective use of the latter, together with added safety of operation for both; but all these benefits can only accrue from making the aircraft to complement the almost immutable human qualities of crew and passengers. The author has worked on this subject since 1928, became more deeply involved in 1935, and for about 10 years conducted a definite study with a series of laboratory investigations at the Harvard school of business administration in which other departments participated, including the medical school.

H. H. F., W.S.E.

Present Advances in Materials

Engineering Materials, by Alfred H. White. McGraw-Hill, New York. 1948. 686 pages. $6.00. 2nd Edition.

It is the aim of this book to enhance the engineering students understanding of the behavior of the wide variety of materials with which the Engineer works.

Chemical and physical properties and behavior of these materials starts one on the road to their wise utilization.

(Continued on opposite page)

Book Browsings

Books Available at WSE Headquarters

Engineering Materials, Continued

The manufacture shaping and fabricating of metals—both ferrous and nonferrous—in their molten, plastic, elastic states or combinations of these are discussed, always with their behavior and use in mind. A good portion of the book is devoted to non-metallic materials used in construction work. Fuels and combustion, water and its industrial uses, wood and wood products, plastic materials and corrosion of metals and protection are some of the other subjects discussed.

This book has undergone considerable revision. New material has been added. It is well illustrated and indexed.

Practicing Engineers may find in it a systematic presentation of recent advances in the field of materials.

J. K., W.S.E.

Text on Passive Networks

Transmission Lines and Filter Networks, by John J. Karakash. The Macmillan Co., New York, 1950. 413 pages.

Compiled as an engineering text for undergraduates, this book covers the subject of passive networks as applied to communications engineering. It is subdivided into three main section; the first dealing with steady-state transmission lines, the second with elementary network theory, and the third with electric wave filters. A fourth section contains appendices reviewing Maxwell's equations, matrix algebra, and some material on wave guides.

The material contained in the book is not new, but it is a fairly complete collection under one cover of the classical and practical data on lines and filters. This makes it a handy reference volume for communications engineers.

An indication of the scope of the book can be gained by listing a few of the applications which are touched upon, beyond the usual theory: skin effect, variation of telephone line parameters with frequency, multiple-stub impedance matching, graphic solutions and charts, standing wave measurements, beaded coax lines, exponential lines, crystal filters and transmission line filters.

W. F. L., W.S.E.

Electronic Articles Index

Electronic Engineering Master Index 1935-1945, edited by Frank A. Petraglia. The MacMillan Co., New York, 1946. 209 pages, $6.00.

This volume indexes electronics articles appearing in 65 periodicals for the period 1935-1945. The publications covered include not only the major ones directly associated with electronics, but also those of allied fields such as architecture, physics, aviation, etc. Except for one French and one German journal, all of the periodicals indexed are American and British.

The arrangement and style is similar to that of the familiar Readers' Index to periodicals.

W. F. L., W.S.E.

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TEXTILE ENGINEER, Chem. 43. Twenty yrs. industrial management, production, quality control, laboratory research. Desires position research, production, liaison, management, where originality counts. $6000. Chicago 836-MW

ARCHITECT, B.S. 35. Four years architectural remodeling and interior decorating for large retail store. Twelve yrs. general architectural design covering churches, schools, theaters, public buildings, hotels, railroad cars, murals, furniture and offices. Good in color schemes. $6500. Chicago 837-MW

ASSISTANT SUPT. E.E. 48. Since Aug. 1949 in U.S.A. Handling all kinds of electrical motors, accessories, electrical appliances, former owner of large repair shop; desires appropriate position Open. Chicago 838-MW

METALLURGIST. Met. Eng. 34. One yr. met. eng. and sales development of molybdenum. Eleven yrs. production heat treating and testing alloy steels. $6000. Midwest. 839-MW

METALLURGIST, Met. Eng. 37. Three yrs. met. testing and control non-ferrous and rare metals, particularly for electrical usage. One and a half yrs. computing furnace charges for brasses and phosphor bronzes. Knowledge of electric furnaces. $5200. Chicago 840-MW

METALLURGIST. 42. Eight yrs. director mill metallurgy—steel mill. Three yrs. Asst. Chief Metallurgist steel company. Six yrs. metallurgical ferrous metals. Two yrs. inspector. $7500. Midwest 841-MW

SALES OR FIELD ENGR. C.E. 23. Five mos. field instrument man with construction company. Five mos. architectural field representative. Some part time doing field construction engineering. $325 mo. Midwest. 842-MW

SALES MANAGER. 49. Recently V.P. radionics mfgr. Extensive exp. selecting men who can sell; also in training salesmen to obtain more business at less sales resistance. Exp. includes selling dealers for resale and direct to consumers. University degree. Will work anywhere. 843-MW

MECHANICAL ENGINEER. M.E. Age: 42. Twelve yrs. exp. maintenance, construction, general engineering, supervision and production planning, design, detailing and installation process plant equipment. Salary: Open. Chicago area. 844-MW

DESIGN ENGR. M.E. 25. One and a half yrs. exp. design and manufacturing knitting machines and similar machinery. Carry ideas through production stage. Desire design or co-ordination work. $100 week. Chicago 845-MW

MECHANICAL ENGINEER with special training in Physical Metallurgy. Trained in Executive sales promotional work. Supervision, production, knowledge welding, heat treating, piping and piping design. Background petroleum industry, supersonic testing, non-ferrous metals, aircraft, ship construction, liquified petroleum gas stand by work for industrial applications. Midwest $10,000+. 846-MW

PLANT or PRODUCTION ENGINEER. M.E. 32. Three years exp. production line layout, designing finishing systems, material handling equipment, industrial dryers, air heaters, preparation of contracts, cost estimates and selection of plant equipment. $6000 Chicago area. 847-MW

MANUFACTURING ENGINEER, M.E. 27. Four years exp. mechanical and electrical design sheet metal and light structural steel fabrication. Knowledge of welding and materials, purchasing exp. Midwest. $400. 848-MW

POSITIONS AVAILABLE

R-7318 ELECTRICAL DESIGNER E.E. Age: 26-30. 6 mo. exp. design, layout and drafting electrical circuits and centrals for industrial plants. Knowledge of processing plants helpful. Duties: Board work on electrical phases of a chemical processing plant. $3000-$4000. Chicago.

R-7319 (a) STRUCTURAL DESIGNER Age: 30-45. 5 years designing concrete or structural steel work. Knowledge of stress analysis. Informed about floor design and rigid frames. Duties: prepare drawings and computations or layout, size, shape and strength of structural members of chemical plants. Salary: Open. Location: Delaware.

R-7319 (b) INDUSTRIAL WASTE ENGINEER, CHEM. SAN. or C.E. Age: 25-35. 5 years exp. industrial waste disposal or public pollution abatement. Duties: Consultant on treatment, recovery or elimination of industrial waste for chemical plant. For a manufacturer of chemicals. Salary: Open. Location: Delaware.

S-7320 TIME STUDY ENGINEER. Age: 30. 3 years exp. needles trades, time study. Knowledge of incentives helpful. Duties: Take time study and methods for dress manufacturer. Salary $5000-$6000. Location: Illinois.

R-7322 SALES — cutting oils. Education: Petroleum or Metallurgy. 2 years exp. previous industrial sales of metal working lubricants. Knowledge of machine shop applications. Duties: Industrial sales of cutting oils. $350 up. Chicago. Care Required.

R-7324 ASSIST. FIELD ENGINEER, B.S. in C.E. Age: 20-33. 1-4 years exp. preferable but not absolutely necessary. On building construction or design. Knowledge of civil engineering. Informed about construction techniques. Duties: Assistant Field Superintendent. On large and small construction projects for a general contractor. Salary $200-$360. East Chicago and Lake County.

INDUSTRIAL SITES with "ELBOW ROOM" in CHICAGO AND NORTHERN ILLINOIS

The increasing productivity in all our manufacturing industries, *and the continuance of this increase which must take place to support our present economy,* again bring the great industrial advantages of the Chicago and Northern Illinois area into sharp focus. Important among these is "elbow room" . . . room for industries to expand, if they need to, and desirable living facilities for increasing numbers of employes.

Here in an area of 11,000 square miles, Chicago and Northern Illinois, a multitude of desirable plant sites are available—all within easy access to the greatest industrial center of the United States and yet all offer that advantage which is so essential in these days—*decentralization and room to grow.*

Add to this, the tremendous facilities in Chicago and Northern Illinois for transportation, marketing, research, education, culture and good living and you have a combination of industrial advantages unequalled elsewhere in the world.

Whether the requirements of your business are those of a compact industrial area or those to be found in smaller but easily accessible cities nearby, the Chicago and Northern Illinois area offers the necessary diversity to include the type of location you need.

A LETTER TO US . . . describing your requirements will bring you a careful analysis of this area's advantages as they apply to your business. Or, if you wish, we will send you a carefully screened list of the available buildings or sites that would be suitable for your operations, based on the information you give us. We keep all such inquiries confidential. Just write us.

Industries in the Chicago Area have these outstanding advantages: *Railroad Center of the United States • World Airport • Inland Waterways • Geographical Center of U. S. Population • Great Financial Center • The "Great Central Market" • Food Producing and Processing Center • Leader in Iron and Steel Manufacturing • Good Labor Relations Record • More Than 2,800,000 Kilowatts of Power • Tremendous Coal Reserves • Good Government • Good Living • Good Services for Local Tax Dollars.*

TERRITORIAL INFORMATION DEPARTMENT

Marquette Building—140 South Dearborn Street, Chicago 3, Illinois—Phone RAndolph 6-1617

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